Operational Synchronization--
Maintaining The Decisive Advantage

A Monograph
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ABSTRACT

OPERATIONAL SYNCHRONIZATION--MAINTAINING THE DECISIVE ADVANTAGE, by Major Michael E. Boatner, USA, 54 pages.

This monograph proposes a conceptual approach to operational synchronization intended to address the post Cold War planning environment. Synchronization has a dual nature as both a process and an outcome, and joint doctrine calls it the "arrangement of military actions [air, land, sea, space, special operations] in time, space, and purpose to produce maximum relative combat power at the decisive point and time." However, there remains much ambiguity concerning the specific nature of synchronization despite the recent flood of joint doctrine. Potentially, in addition to synchronizing the joint services, it includes synchronizing the six battlefield functions, allied or coalition operations, the phases of a campaign, and the tactical, operational, and strategic levels of war.

As response times for operational action compress due to technological advance, synchronizing operational functions will be a key source of advantage or asymmetry. At the joint level, commanders must not only set the conditions for tactical success, but also synchronize their campaign plans with the non-military dimensions of the strategic environment.

This monograph reviews the theoretical basis of the tenet of synchronization and its role in current joint doctrine. Combining this with a selective analysis of recent writings on campaign planning leads to a conceptual approach to operational synchronization based on interdiction. Issues include identifying the key operational/strategic dimensions, the transition from planning to crisis action, the implications of Operations Other Than War (OOTW) and the basis for decision support.

TABLE OF CONTENTS

The Army must be capable of achieving decisive victory. The Army must maintain the capability to put overwhelming combat power on the battlefield to defeat all enemies through a total force effort. It produces forces of the highest quality, able to deploy rapidly, to fight, to sustain themselves, and to win quickly with minimum casualties. That is decisive victory.--FM 100-5

I. INTRODUCTION

The preceding definition of decisive victory appears in the Army's newest capstone doctrinal manual and mirrors much of the interservice thinking on warfighting. As this definition of military success permeates joint doctrine, it clearly represents an unprecedented challenge for future military campaigns and theater commanders.[2] Apparently, the stricture on casualties applies not only to friendly forces, but to enemy forces and noncombatants as well. How will joint commanders contend with the obvious difficulty of employing "overwhelming combat power on the battlefield" while minimizing the attendant destruction and suffering?

The nature of future military operations promises to span a broad range of possibilities from humanitarian intervention to operational maneuver of heavy forces. This will make the "total force effort" different in scope and kind from one contingency to next. Military forces will probably operate exclusively in a joint environment and almost inevitably as part of a coalition or alliance effort.[3] Under these circumstances, the application of military force will require a subtlety and a versatility uncharacteristic of Cold War era planning. Public and political expectations in the wake of DESERT STORM suggest military force will need to be very accu-

rately and efficiently applied to achieve very specific objectives in support of national interests.

In addressing the requirements for successful campaigns in the future, doctrine suggests that the principle of joint synchronization holds great promise of meeting the challenge. The Army Chief of Staff, General Gordon R. Sullivan said "the challenge is to better synchronize our battlefield operating systems while denying the enemy the ability to synchronize his."[4]

Although the term synchronization has been a central tenet of Army doctrine for over a decade, its meaning remains ambiguous at the joint or operational level. Synchronization has a dual nature as both a process and an outcome, and Armed Forces Staff College Publication 2, Service Warfighting Philosophy and Synchronization of Joint Forces (Aug 1992) calls it the "arrangement of military actions in time, space, and purpose to produce maximum relative combat power at the decisive point and time."[5] Although this is clearly desirable at any level of war, the recent outpouring of joint doctrine does not as yet provide a methodology for "synchronizing" operations either in planning or execution.[6] Even in an article entitled "*Delivering Decisive Victory: Improving Synchronization,*" General Sullivan confesses: "I have focused on the foundations of successful synchronization, while avoiding the specific processes involved."[7]

Doctrine makes increasingly challenging demands of efficient synchronization requiring a multi-dimensional outlook.

> The Army must be capable of ***full-dimensional*** operations. This means employing all means available to accomplish any given mission decisively and at the least

> cost--across the full range of possible operations in war and in operations other than war.[8]

As response times for operational action compress due to technological advance, synchronizing operational functions can itself potentially become a key source of advantage or asymmetry. Synchronizing faster and/or better than the enemy may allow you, by acting faster, to defeat the enemy's synchronization. The joint definition recognizes the five dimensions represented by three-dimensional space, plus time and purpose. Are there other dimensions (battlefield variables, factors, elements) to synchronize, and, if so, how do they impact on "full-dimensional operations?"[9] At the joint level, commanders must not only manipulate combat power to set the conditions for tactical success, but also synchronize their campaign plans with the non-military dimensions of the strategic environment. A key concern might be which dimensions of the battle space and which dimensions of the non-battle space will predominate in any given contingency. A conceptual framework for synchronizing the campaign must be inherently flexible across the spectrum of military operations, without being so general as to lack utility as a planning and execution tool.

In essence the framework or methodology for synchronization is a modeling process. The joint commander will reduce the plan in all its complexity and detail to focus on its essentials at the operational level. It will be important to restrict the model to operational timeframes, operationally significant formations and targets, and link them to operational/strategic objectives. This will decrease the propensity for overly centralized control and undermining initiative.[10]

Ultimately the goal is a flexible model of the plan, with its sequels, branches, and essential relationships. The staff updates the model as events unfold. Decision makers then make changes to the plan as circumstances warrant, either in conformance with expected branches (planned decision points) or as unexpected opportunities arise (fragmentary orders).

Operational synchronization has been addressed frequently in military doctrine, academic work, and professional journals. However, the discussion is almost always general in nature, tending to emphasize its central importance rather than its mechanics. Several matrix approaches have great potential, but to date have emphasized the set-piece character of Cold War planning.[11] Simple standard matrices may not meet the needs of synchronizing an unconventional peace enforcement operation or a humanitarian aid mission in a high risk theater. This is an effort to investigate how the synchronization challenge has evolved in the post-Cold War strategic and operational environments.

New environmental factors will fundamentally change the nature of future contingencies. These have been widely reported and include the proliferation of weapons technology, the requirement to project forces from within the continental United States, the reliance on forward bases and extended lines of communications (LOCs), the potential to operate in undeveloped theaters, the diplomatic necessity of coalition action, and the versatility of missions embodied in operations other than war (OOTW).[12] If nothing else these will impose variability in the operational functions that

are active in any given contingency (e.g. operational fires versus restraint).

This monograph reviews the theoretical basis of synchronization in staff analysis and battle command. It then investigates synchronization's role in current joint doctrine. Subsequently, the analysis of campaign planning issues will lead to a conceptual approach for operational synchronization. These planning issues include identifying the key operational/strategic dimensions, the implications of operations other than war, the transition from planning to crisis action, and the basis for decision support.

> *The strategic elements that affect the use of engagements may be classified in to various types: moral, physical, mathematical, geographical, and statistical . . . they are usually interconnected in each military action in manifold and intricate ways . . . [resulting in] a dreary analytical labyrinth.--Clausewitz*[13]

II. THEORETICAL FOUNDATION

As in most classical references to strategy, Clausewitz is combining the operational and strategic levels of war. Where his strategy involves the theater military assessments of deciding where, when, and with which forces engagements will be fought, current thought would classify it as the operational level.[14] Similarly confusing, the doctrinal term synchronization has its foundation in the tactical level of war. Thus, in reviewing the theoretical implications of operational synchronization, it is important to remain focused beyond the combined arms or tactical level of war and short of the strategic level. Because it is questionable when theorists began to appreciate the efficiencies and creative potential of the

operational art, it is important to insure that specific theoretical observations apply. It is by no means assured that a synchronization methodology for combined arms parallels that of joint and combined forces.

At the operational or joint level synchronization is materially different in both scale and scope. Campaigns are of broad scope, involve major formations, and accomplish strategic objectives in a theater of operations. Dr. James Schneider proposed that the operational level of war is characterized by distributed operations of large durable formations against a distributed enemy. The leadership must further have a theater-level perspective to synchronize these various operations, and their sustainment, against decisive points in support of the strategic aim.[15]

synchronize . . . To operate or cause to operate in unison.[16]

Role of Intuition, Initiative, and Intent

The weight of military opinion is very consistent in putting the responsibility for unified action squarely on the theater commander's shoulders. His commander's intent is founded upon the combination of his analysis, intuition, and initiative. He achieves unison (or synchronization) when he not only makes the correct decision, but follows it up with execution faithful to his intent. Effective joint force staff support is essential to this linkage. Further, there is a requirement for every subordinate commander to "*regard his superior's intention as sacrosanct*, and make its attainment the underlying purpose of everything he does."[17]

Commanders subordinate to the theater commander, generally operate at the tactical level in their respective services. Absolute responsiveness to the joint commander's intent puts a significant burden on his competence and on the ability of the joint force staff to implement his decisions efficiently. This leads to the question of how much of a role mathematical analysis plays compared to intuitive judgement. Clausewitz put a major premium on the talent, experience, and genius of the commander, stating that analytical models would stifle the inspiration of genius and thus, always prove inadequate.[18] However, Peter Paret observed that Clausewitz acknowledged the role of analysis and more mechanical methods for helping average men cope with complex operations. [19] Presumably, this applies to the more average staff personnel charged with implementing inspired decisions.

In modern operations, we are less inclined to count on genius and expect instead a high standard of competence and teamwork at each level of command. Clausewitz would disagree and insist ". . . an eminent commander needs more than experience and a strong will. He must have other exceptional abilities as well."[20] This is increasingly true the higher the level. According to Clausewitz, tactical problems are solved with "courage and self-sacrifice." Higher level problems require more and more "intelligence and judgement." At the highest level almost all solutions require "imaginative intellect."[21] Engagements and the physical factors that define them lend themselves to modelling, but defining the purpose of the engagement and higher level relationships becomes less satisfactory.[22] Since the

goal of synchronization is to model the ongoing campaign, a methodology, if it is possible must accommodate imaginative solutions while supporting the mechanics of execution.

Most observers would agree that success of a campaign is not solely dependent on the relative genius of the opposing commanders. Many environmental factors will apply based upon initial conditions, friction, and chance. Whether at the outset of the campaign or at a potential branch, each pursues a decisive advantage over the other. In deciding to act "the determinant is really the same for both commanders: the probability of improvement, or deterioration, of the situation in the future."[23] In modern warfare the commander's ability to make the right determination is largely a function of the structure he inherits via the current national strategy guidelines. He does have some ability to tailor his staff and select from a limited menu of national (and possibly allied) capabilities, but he will "see the battlefield" through remote agencies and technical means. As forces are committed to increasingly unfamiliar operations, this tailoring will be by trial and error as much as inspired design.

In his foreword to Race to the Swift, General Donn Starry said, historically the winning commanders

> were those who somehow seized the initiative from the enemy, and held it to the battle's end. Most often the initiative was successfully seized and held by maneuver. This seems to true whether defending or attacking, outnumbered or outnumbering.[24]

Rapid, competent execution of a feasible plan is the key to gaining the initiative once the commander perceives an important opportunity. If his synchronization methodology, whether formal or informal,

allows him to implement his intent faster than his opponent can counteract it, then he will retain the initiative. One commander's opportunity may not coincide with his opponent's or even be his best opening for taking the initiative, but if he exploits it effectively, it can still lead to success. Essentially, seasoned commanders employ an intuitive approach to decision making which allows them "to use their experience to recognize a situation as familiar, which gives them a sense of what goals are feasible, what cues are important, what to expect next and what actions are typical in that situation."[25]

Starry went further to lay out the proper goals for an operational campaign. First, deny the enemy his objective or success, which usually equates to protecting your own center of gravity. Second, prevent him from massing reinforcements behind the assault echelon, or in other words, attack his operational formations in depth. Finally, he includes: "Find the opportunity, seize the initiative--by maneuver to attack and destroy the integrity of the enemy operational scheme, forcing him to break off the attack or risk resounding defeat."[26] Each of these goals requires projecting the enemy's alternatives, developing a plan that uses your own resources efficiently, confirming or denying the enemy intent in near real-time, and responding flexibly to the situation as it develops. Presumably, to the extent the commander has considered multiple eventualities in advance, he can streamline his reaction to actual events as they unfold.

> The good general must know friction in order to overcome it whenever possible, and in order not to

> expect a standard of achievement . . . which . . . [is] impossible. . . . Practice and experience dictate the answer: "this is possible, that is not."[27]

Once he has the considered the possibilities, the operational commander must communicate his intent and degree of flexibility to a large and diverse team of staff personnel and subordinate commanders (the joint force team). This is where the friction begins and standardized procedures and teamwork can make a big difference. At the operational level, it is probable that the joint force team participates fully in developing the specifics of the operational aim, the campaign plan, and any contingencies from the strategic guidance. This advanced deliberate planning will greatly assist the execution of crisis action planning because of the team building effect. The staff will not only familiarize with the issues, they will learn the command style of the joint commander.[28] In fact, studies of real-world team decision making

> found the team behaving much like individuals -- generating a plausible option, evaluating it by imagining what could go wrong, trying to "satisfice," trying to improve the option to overcome its limitations and sometime rejecting or tabling an option to move in a more promising direction.[29]

This team process is particularly important in an operation that does not resemble ones the team has participated in previously. Like any team sport, Richard Simpkin said execution in war is based on "*the members themselves reading the instantaneous local situation and reacting to it in accordance with their understanding of the aim and plan* (Simpkin's emphasis)."[30]

> The man of action must at all times trust in the sensitive instinct of judgement, derived from his native intelligence and developed through reflection, which almost unconsciously hits on the right course. At other times he must simplify understanding to its dominant features, which will serve as rules; and sometimes he must support himself with the crutch of established routine. . . . One of these simplified features or aids to analysis, is always to make sure that all forces are involved--always to ensure that no part of the whole force is idle.[31]

Simultaneity/Concentration

Overwhelming combat power at the decisive point and time to achieve mass is a well-accepted principle of war and implies both simultaneity and concentration.[32] If combat power is massive, but dispersed it will not be overwhelming. If it is employed over too great a time span, employment will become "piecemeal" and, thus, easier to withstand. Additionally, it is widely accepted that the desired goal is simultaneous concentration of combat power *effects* (versus forces) on the enemy at the decisive point and time. Actions in time to achieve those effects must be offset according to the decision maker's judgement combined with the best available planning factors and projections. However, synchronization to accomplish mass effects requires special attention and effort because ". . . the very nature of war impedes the simultaneous concentration of all forces" and ". . . it is contrary to human nature to make an extreme effort."[33]

In overcoming the friction inherent in joint operations, the standard of simultaneity and concentration will not be absolute. The joint force team will seek to focus the effects of maximum available combat power at approximately the same time. The Russian perspec-

tive on this time tolerance suggests that events exert simultaneous pressure "if one follows the other within the enemy's response time at the level affected."[34] This is comparable to our concept of acting inside the enemy's decision cycle. Knowing how quickly the enemy can react is critical to understanding the standard of simultaneity to which the joint force must adhere.

Clausewitz wrote calculating the relationships of space and time is the "daily bread" of strategy, but it is not the most difficult or decisive factor. It is essential to attaining "relative superiority . . . at the decisive point," but less important than "the correct appraisal of the decisive point, [or] on suitable planning from the start."[35] Similarly, Jomini called the proper choice of objective points of maneuver "The greatest talent of a general and the surest hope of success . . ."[36] Thus, both put the primary emphasis on the commander's judgement in deciding where to synchronize effects, but also acknowledged the routine analytical challenge in execution.[37]

Simpkin proposed a physical maneuver metaphor based on the stationary holding force, a mobile exploitation force, and their relative mass and mobility. According to Simpkin's metaphor, the effects of *mass* can be enhanced by two other characteristics--*tempo* and *depth*. Tempo (or velocity) consists of depth (or distance) over time and, in combination with mass, yields *momentum*. Momentum is the decisive characteristic of the mobile exploitation force, while the holding force relies on pure mass. Simpkin also introduces the concept of *leverage* which is a physical advantage accruing to a mass positioned in depth. As mass times depth it is a subset of

momentum, and by extension, momentum can be expressed as leverage (mass times depth) over time.[38] Thus, the effectiveness of a certain mass of combat power can be multiplied by merely its superior mobility or a positional advantage with respect to the enemy. Potentially other less intuitive battlefield attributes can serve as similar "combat multipliers." If every soldier and tank is more capable (e.g. kills faster from farther away) than those of the enemy, does that allow the commander to multiply by a lethality factor or is lethality intrinsic to the combat power of the mass? If situational awareness on the digitized battlefield allows increased accuracy to employ existing resources with greater efficiency (e.g. fewer rounds/missiles/units miss), should the staff develop and apply an efficiency factor? Simpkin identified *surprise* and *pre-emption* as two other powerful multipliers, that at the operational level will create a synergistic effect with strategic impact.[39]

Complementary Capabilities

The viability of heavy versus light forces sparked heated debate during the competition for funds in the Army during the 1980's when the pendulum swung towards light forces. Simpkin reflected this attitude with: "Heavy forces . . . will for some time provide an unusable deterrent, . . . providing by [their] inertia a much-needed stabilising force."[40] This proved to be less than prophetic regarding the useability and deterrent value of heavy forces during Operation DESERT STORM. The perception of both useability and deterrent value are now probably relatively high in

the wake of their performance in the desert. However, one or two contingencies like Vietnam or Bosnia-Herzogovina could change that perception quickly.

Simpkin further wrote that the tempo mismatch between heavy, light, and air assault forces will prevent them from cooperating effectively at the operational level. "The heavy force and the light force will each be capable within itself of applying manoeuvre theory at the operational level, of forming a holding force and a mobile force. And the two will interact at the strategic level."[41] Although concerns with the relative tempo of these forces are valid, if Simpkin is right it certainly bodes ill for cooperation at the joint level between holding and mobile forces from different services. As competition for force structure continues, capabilities will begin to appear in single services only and joint operational maneuver will be required.

> "the prospect of eventual success does not always decrease in proportion to lost battles, captured capitals, and occupied provinces."[42]

Asymmetry

Clausewitz cited several examples of Napoleon's enemies who demonstrated the only way to beat his armies was to refuse to fight him on his own terms. He defeated every army that met him symmetrically on the battlefield by his superior ability to mass combat power at the decisive point and time. The Russians exploited their "immense spaces" to exhaust Napoleons armies, proving for Clausewitz that not every country could be conquered.[43] The

Spanish took advantage of difficult terrain, forcing the French to disperse rather than concentrate and making the use of calvary formations infeasible.[44] He also pointed out terrain that naturally affords cover works to the disadvantage of the force with superior firepower. These observations predicted the kinds of difficulty better equipped modern forces would have finding military success in places such as Vietnam and Afghanistan. However, achieving a significant mobility advantage in difficult terrain through airmobility can offset the positioning ability of the more heavily armed force.

In particular, Clausewitz observed the "heart and temper" of an enemy fighting in and for its own homeland makes an important though often underestimated contribution to "its politics, war potential, and fighting strength."[45] This may translate to an impressive resolve to prolong hostilities and tolerate casualties that tax the invader's commitment to limited aims. Interestingly, Clausewitz also mentioned that nations characteristically take limited military action to achieve limited aims and then adopt a defensive, passive posture to await more favorable conditions or a half-hearted response.[46] When this response is not an overt, symmetrical response, but rather rejection by an armed popular movement from within, the conventional force is vulnerable to the challenges of protracted unconventional operations. In the same context of internal intervention, Jomini cautioned: "calm the popular passions in every possible way, exhaust them by time and patience, display courtesy, gentleness, and severity united, and (particularly) deal justly."[47]

> . . . *immobility* and *inactivity* are the normal *state* of armies in war, and *action is the exception.*[48]

Tempo

Simpkin wrote that *tempo* is more than what can be loosely described as the "operational rate of advance . . ., " it is a complex of mutually interacting elements. These are: physical mobility, tactical rate of advance, quantity/reliability of information, C3 timings, times to complete moves, pattern of combat support, and pattern of service (logistic) support.[49] He also makes the unique observation that tempo is characterized by a dual symmetry composed of *mounting tempo* (preparation) and *execution tempo* which have historically been about equal.[50] This provides two areas to focus on improving tempo through synchronization of the key interacting elements.

Clausewitz wrote that slower operations provide greater opportunity to retrieve mistakes, make complete assessments, and calculate chances in planning.[51] Presumably an increase in tempo (to achieve the benefit of Simpkin's momentum) will therefore increase the risk of making a fatal mistake or basing a plan on incomplete calculations and assessments. Aside from the decision making risk, Clausewitz also said delaying an operation "over a longer period than the minimum needed to complete it *makes it not less difficult, but more.*"[52] Apparently, this is due primarily to friction and the increasing service support overhead. Thus, the operational implications of tempo are that shorter campaigns are less difficult, have potential to achieve momentum, but entail more risk based upon faulty decision making.

Depth

Clausewitz framed operational maneuver in terms of two pairs of opposites in tension. "The first pair of opposites consists of outflanking the enemy or of operating on interior lines; the second, of concentrating one's forces or of extending them over numerous posts."[53] By way of illustration, it could be said that Operation DESERT STORM demonstrated operational maneuver of concentrated forces on a flank, while Operation JUST CAUSE consisted of dispersed forces inserted to achieve interior lines and prevent enemy concentration. Clausewitz also linked the significance of depth to the concept of the culminating point, having observed: "The attacker's rear is inherently more vulnerable than the defender's . . ." and "What matters therefore is to detect the culminating point with discriminative judgement."[54] This implies that maneuver to operational depth (normally the enemy rear) will be more difficult in the offense than in the defense because the defender's rear is inherently less vulnerable. This is intuitive, as the defender will normally have interior lines and greater situational awareness as the attacker approaches culmination and essentially exposes his rear toward the defender. However Simpkin suggests that in order to exploit interior lines, the defender may need good going (intra-theater mobility) even more than the attacker.[55]

Simpkin stated that the mass of the holding force in the close fight extends the battle to operational depth, while the momentum of the mobile force penetrates beyond operational depth.[56] Starry agreed that operational impact (achieving operational goals with

operational resources) necessitated extending the battle in depth to units not in contact, projecting requirements forward in time to support the current battle, and extending the range of assets (joint acquisition/attack means) brought to bear.[57]

Once the attacker penetrates beyond operational depth he can achieve and should exploit interior lines.[58] As an example, Grant achieved this when he penetrated Mississippi east of Vicksburg and centered himself between Pemberton's forces and Johnston's operational reserve in Jackson. However, as with Grant, this situation will almost inevitably entail significant risk to LOCs and sustainment.

The legitimate object of war is a more perfect peace.[59]

Operations Other Than War (OOTW)

Echoing the sentiments Sun Tsu, Mahan called fighting "a rather inelegant last resort of maneuver warfare." Far preferable are *dislocation* (win by maneuver), *pre-emption* (fleet in being) and *deterrence* (inhibition without mobilization). "The presence of a strong force, even though inferior, near the scene of operations will produce a momentous effect on the enemy's action."[60] This is particularly true of operations other than war where regardless of non-military tasks assigned, preserving and improving the quality of the peace predominates.

Starry refined the challenge of OOTW by stating that military planners' peacetime goal "is to reduce to a minimum the enemy leadership's incentive to seek military solutions to political prob-

lems." But once military forces are employed, something must be won in order to give politicians a position from which to bargain. Avoiding defeat is not sufficient. Strategy must "postulate a definable, recognizable (although perhaps limited) victory for the defender."[61] Mahan further emphasized the importance of seizing the initiative from the outset of hostilities with: "If a solution cannot be reached without battle, this imposes on you the strategic aim to force battle at the time, and under the conditions, most favourable tactically to yourself."[62] This outlook requires a political willingness to pre-empt the opposition based on hopefully prearranged engagement criteria. In the case of a joint OOTW scenario, many of the military capabilities are complicated by the unpredictable repercussions of their use.

> ". . . the main lines of every major strategic plan are *largely political in nature*, and their political character increases the more the plan applies to the entire campaign and to the whole state. . . . According to this point of view, there can be no question of a *purely military* evaluation of a great strategic issue, nor of a purely military scheme to solve it."[63]

Modeling

A synchronization methodology or model is ideally "an abstraction of reality" that the commander can use in his effort to visualize and influence the operationally significant events in his execution.[64] Synchronization is an attempt to model the essential relationships between events/actions and their results in time and space. "A model is potentially useful to analysts and decision makers because it represents the real world (or that portion of the

world with which one is concerned at the moment) but does not replicate it."[65] Models describe, prescribe, and predict in varying degrees according to their purpose.[66] The joint decision maker is monitoring and controlling the *ways* in which he employs his *means* in opposition to the enemy's ways and means to achieve his political or strategic *ends*. Treating synchronization as a model may help the decision maker bring order to the process, structure and discipline the staff interaction, assess strengths and weaknesses of alternatives, expose new issues, provoke insights, and reveal opportunities. Like any modeling process, it will not make the decision, substitute for deliberate concentrated analysis, nor answer unasked questions.[67]

Military models have two main purposes: investigative and resource management.[68] In addressing operational synchronization, investigative models would support wargaming and course of action development, and resource management models would support decision making. Wargaming and decision support represent the process and the outcome dimensions of synchronization.[69]

The Army Models Review Committee has established several properties for evaluating military models.[70] For a conceptual model to support synchronization and achieving the commander's intent the most critical property is probably visibility to the commander and staff analyst. Visibility (versus opacity) to user and analyst is extremely important and is the "understandability of the model and its results."[71] This is the essence of a synchronization model's utility.[72] The model results from understanding the processes, and then documents that understanding for updates, revision, and

exploitation. A useful model will allow many decisions to be effectively made in advance. Among the myriad, complex operational relationships it should also isolate the decisive ones and represent them in a way that supports rapid, accurate, decisions. These decisions could also be conceptually (intent) communicated efficiently in terms of the model's framework.[13]

A danger in modelling is the attempt to create generic or standing models that can benefit over time from greater development resources, but do not match the requirements of a given campaign. Generally, in order to justify cost, they try to do too much and will often have fatal flaws for a specific situation. Other problems include tedium of data input, opacity of processes, lack of detailed (accurate) input data commensurate with model capability, large numbers of parameters and parameter combinations, and difficulties of corroboration of data and findings.[14] Although these problems address fully automated models, they highlight the problems also found in complex partially manual models .

Synchronization matrices (models) will not be transferrable from one operation to the next, nor is that necessarily desirable (standing models). Staffs and commanders will tailor them to their specific requirements for each contingency and inject many subjective elements as their judgement dictates. Hughes further stated the obvious principle that the more the decision maker himself participates in the modeling process ("selection of decision criteria, scenarios, assumptions, and model properties"), the more intrinsically the model will be involved in the decision making process (directly

implemented).[15] Clearly commander involvement will make the model a more practical and accurate reflection of his estimates and intentions.

Battle models can credibly represent rates of change but "they cannot hope to capture the two-sided process of action-reaction-counteraction."[16] Fortunately this is less necessary at the operational level where macro projection of movement and attrition rates is probably achievable. "A good battle model yields trends, insights, and with due caution, order-of-magnitude indications of likely battle outcomes *under given circumstances*."[17] This standard may allow the commander to project, represent, and monitor (i.e. synchronize) his key decision points from the planning phase through execution using the same basic modeling method.

In combat where a huge advantage results from acting faster than the enemy, modelers should not become overly enchanted with optimization.[18] Decisions that provide significant advantage (versus optimization) in a timely fashion are the goal. Every decision is an attempt to increase the probability of a favorable outcome and thus reduce the risk. This implies it is often better to act on the first good opportunity that arises, rather than to wait for a best chance or for the enemy to accommodate your plan exactly.

A final issue is the amount of overhead to be dedicated to establishing and maintaining the model. A full fledged predictive simulation of the projected campaign will rarely be practical. Realtime events must be input efficiently and data elements must be restricted to those impacting on operationally relevant functions.

Models entail costs and overhead which must always be balanced against their utility. The effort of feeding the model must be worth the gain in situational awareness and decision support and not distract from the ability to make the decision.[79] Conversely, it is very important to identify all highly relevant factors for modeling, without undue emphasis on detailed inputs and outputs (e.g How many infantryman must attack, how many tanks will be lost?). As Albert Einstein once said: "Everything should be as simple as possible -- but no simpler."[80]

Role of Theory

Understanding synchronization is a the heart of Clausewitz' stated purpose for theory:

> Theory will have fulfilled its main task when it is used to analyze the constituent elements of war, to distinguish precisely what at first sight seems fused, to explain in full the properties of the means employed and to show their probable effects, to define clearly the nature of the ends in view, and to illuminate all phases of warfare in a thorough critical inquiry.[81]

In his career-long pursuit of divining these cause and effect relationships, the commander can take theory "from the objective form of a science to the subjective form of a skill. . ." where ". . . It will, in fact, become an active ingredient of talent."[82] The talented operational commander cannot allow synchronization to deteriorate into a strictly mechanical staff drill, because it would become too predictable. That would make friendly synchronization vulnerable to the manipulation of an enlightened enemy.

arrange,coordinate,integrate, unify, blend, harmonize, orchestrate, affiliate, align, calibrate[83]

III. JOINT DOCTRINAL FOUNDATION: CURRENT AND EMERGING

The term synchronization became a fundamental tenet to the Army's Airland Battle doctrine with the publication of the 1982 Field Manual 100-5 Operations (FM 100-5). Based on the classical concept of skillfully concentrating combat power in space and time, joint doctrine has since embraced synchronization as a central concept at the operational level of war. However, despite the importance of the concept, the term itself now permeates military speech and writing, often as a synonym of one or more of the related words presented above.[84] In surveying the primary joint doctrinal publications on the Joint Electronic Library (JEL) compact disc (CD), a search returned 122 "hits" in 17 documents, with 50 in Joint Publication 3-0 Doctrine for Joint Operations (JP 3-0) alone. The vast majority of these instances are redundant references to the need to "arrange land, air and sea operational forces in time, space, and purpose to produce maximum relative combat power at the decisive point."[85] Other common usages include synchronizing the six operational functions, synchronizing the phases of a campaign, or synchronizing the tactical, operational, and strategic levels of war. However, several other doctrinal references use the term in ways less central to the operational art such as "synchronizing" joint planning actions to the congressional budgeting process. In any event, even limiting the challenge to synchronizing operations across the services, operational functions, campaign phases, and levels of war leaves the Joint Force Commander (JFC) with a monumental task. Unfortunately,

no satisfactory effort is made to describe synchronization below this conceptual level.

JP 3-0 goes further to define three important concepts, strategy, the operational art, and campaigns in terms of synchronization. First, "Strategy is the art and science of developing and employing armed forces and other instruments of national power in a ***synchronized*** fashion to secure national objectives."[86] Second, ". . . operational art, in particular, focuses on the fundamental methods and issues associated with the ***synchronization*** of air, land, sea, space, and special operations forces."[87] And third, "A wartime campaign is the ***synchronization*** of air, land, sea, space, and special operations--as well as interagency and multinational operations--in harmony with diplomatic, economic, and informational efforts to attain national and multinational objectives.[88] This reinforces the central importance of synchronization, while doing little to illuminate the specific "methods and issues associated with synchronization."

The 1993 FM 100-5 adopted a slightly modified perspective on synchronization by emphasizing "Massing effects, rather than concentrating forces."[89] Instead of converging the physical combat power resources, the commander arranges sequential and simultaneous activities such that their effects coalesce at the decisive point and time. This approach stresses the importance of gauging the time lag between operational action and operational effects on the close battle. It can also limit the vulnerability of the forces to weapons of mass destruction. This has important implications for the

operational level of war since "these activities imply a broader dimension of time or space" than the tactical level.[90]

Tactical combat power is doctrinally defined in terms of maneuver, fires, leadership, and protection. These apply at the operational level as well, but on a greater scale and with greater separation. Operational maneuver, leadership, and protection throughout the theater can still effect the decisive close engagements. Operational fires are not fire support and often will not physically fall at the decisive point. Virtually all operational fires are interdiction and thus isolate the enemy's combat power reserves and sustainment from the close battle.

Beyond these issues, the joint force commander must consider and employ many tools that have strategic and operational effect, but do not necessarily constitute elements of combat power in the traditional sense. Much of this responsibility comes under the heading of *perception management* and dramatically impacts the effectiveness of operations. The commander "combines truth projection, operations security, cover and deception, and psychological operations" aimed at foreign audiences "to influence their emotions, motives, and objective reasoning; and [at] intelligence systems and leaders at all levels to influence official estimates."[91] Although not so specifically acknowledged in doctrine, the commander employs similar means to influence public and political audiences at home and among allies. Clearly these efforts must be synchronized with every application of combat power.

The 1993 FM 100-5 shed more light on the nature on the commander's role in synchronization by stating "Synchronization . . . takes place first in the minds of commanders and then in the actual planning and coordination of movements, fires, and supporting activities."[92] By linking effective synchronization to the commander's visualization and intent for the operation, Army doctrine raises synchronization unambiguously above the level of staff planning and integration. Synchronization becomes the foundation and objective of rehearsals, commanders intent, and operational sequencing.

> To achieve this requires the anticipation that comes with thinking in depth, mastery of time-space-purpose relationships, and a complete understanding of the ways in which friendly and enemy capabilities interact. Most of all, synchronization requires a clear statement of the commander's intent.[93]

The new FM 100-5 goes further to introduce the new concepts of battle command, battle space, and full-dimensional operations. Each of these is a useful attempt to redefine existing concepts in terms that stress a creative and unbounded perspective on operations. The recurring themes are: use all available tools, understand your enemy and the environment, confront the enemy with multiple, simultaneous threats, and achieve synergy by massing effects.

> . . . a general . . . should at least be able to form reasonable suppositions as to what the enemy is going to do and fix for himself a certain line of conduct to suit each of these hypotheses.[94]

Battle Command

Battle command refines the operating system of command and control (C2) to better accommodate the commander's central leader-

ship and decision making role in the generation of combat power. This focus on the command element of C2, stresses the commander's role as the operational artist and architect for the campaign. The commander's vision of "current and future states of friendly and enemy forces" (branches and sequels) becomes the framework for synchronization.[95] Control executed by the staff is clearly subordinated to the commander's scheme for decisive action and exploitation.

Battle Space

Battle space redefines the concept of the commander's area of interest. It is not only the "physical volume that expands or contracts in relation to the ability to acquire and engage the enemy," but "also includes the operational dimensions of combat, including time, tempo, depth, and synchronization."[96] Because the limits of battle space are intentionally not assigned, the commander is challenged "to build a broad vision according to the existing factors of METT-T [Mission, Enemy, Terrain, Troops, and Time Available]" and then "to dominate their battle space."[97] The way commanders define their battle space is ultimately a key part of operational vision and allows them "to keep their options open, protect and sustain their forces, synchronize combat power, and keep the enemy off balance."[98] The battle space becomes the framework for planning and sequencing close, deep, and rear operations that maximize efficient timing and use of resources. By expanding his envelope, the commander contributes to unity of effort

by rising above the idea of area ownership to focus on higher intent and purpose.[99]

Full-Dimensional Operations

FM 100-5's glossary defines full-dimensional operations as "the application of all capabilities available to a joint commander to accomplish his mission decisively and at the least cost across the full range of possible operations." In another instance, it reiterates this as a requirement "to accomplish any given mission . . . in war and in operations other than war."[100] This is comprehensive guidance with no subsequent methodology for accomplishing it, especially in the realm of operations other than war.

Role of Doctrine

Although Army doctrine has spearheaded the expression of operational concepts in recent years, joint doctrine has now embraced its responsibility for operational synchronization. However, beyond increasingly effective statement of theoretical concepts, doctrine has failed to enumerate the specific requirements of synchronization and full-dimensional operations. Joint doctrine must better investigate and explain the relationship between the physical dimensions in which force is applied and the social/political dimensions of perception management. With every new operation other than war being a rule unto itself, doctrinal rigor may be the primary source of joint force preparation.

Interdiction aims to divert, disrupt, delay, or destroy enemy surface military potential before it can be used effectively against friendly forces. --JP 3-03[101]

IV. ANALYSIS AND IMPLICATIONS FOR FUTURE OPERATIONS

At the joint operational level, the commander sets the conditions for tactical success. First, through theater design and deliberate campaign planning, he establishes the basic initial conditions for the campaign. The commander visualizes his battle space in terms of the concepts of design (centers of gravity, lines of operations, and culminating points), and, as von Moltke observed, early decisions have permanent implications for the course of a campaign.[102] Virtually every campaign commences with crisis action planning and a time-constrained ability to adjust the elements of operational design. This is when synchronization begins in earnest with incorporation of specific events and political objectives. From that point on, the operational commander directs resources to the depth of the battlefield from a distance in support of strategic objectives; literally and figuratively from over the horizon. His primary role in execution is to effectively exploit the close battle, while preventing his opposite number from doing the same.

Interdiction/Anti-Interdiction

Because of the scope of his perspective, the commander can think almost exclusively in terms of interdicting the enemy and his intent, both in applying theater forces and sustaining them. This perspective addresses each of the operational operating systems, but also applies when they do not in a less conventional scenario. All

operational fires are essentially interdiction. They delay, destroy, or disrupt forces destined to reinforce the enemy's ability to prosecute his close fight. Targets that do not support the close fight in the near term are strategic, while those already engaged are primarily tactical targets. Even *operational maneuver* can be considered interdictory in design, as the goal is to unhinge the enemy's close fight by penetrating to operational depths with our forces. *Operational logistics* and *protection* must thwart the enemy's interdiction efforts to achieve their purpose of projecting friendly combat power. Thus, opposing operational commanders are engaged in a largely interdiction/anti-interdiction fight. *Operational intelligence* and *command/control* both enhance and multiply the commander's ability to interdict, sustain, and protect effectively.

Having established that perspective, the commander must do several things better than his opponent in order to achieve effective synchronization. First, he must use resources efficiently to maximize effects at the decisive point. Any inefficiency due to friction, chance, or incompetence is an exploitable failing. The more efficient rival gains an important advantage in combat power generation. Second, he must know or accurately forecast what the enemy intends, or he cannot discern the decisive point from which to attack the center of gravity. Third, he must monitor events in near-realtime to know when and where to act. This may supersede the plan, as enemy intentions and actions can change for many unforeseeable reasons. Fourth, he must have the military capability and flexibility to confront the enemy with multiple, simultaneous

threats that effectively interdict the enemy ability to reinforce the close fight.

Key Operational Dimensions

Despite the introduction of *full-dimensional* operations, doctrine limits its discussion to traditional dimensions in its treatment of synchronization. In addition to the physical dimensions of the battle space, doctrine specifically mentions synchronizing military activities in time and purpose. With respect to time, the goal is relative simultaneity of effects (inside the opponent's ability to decide and react). With respect to purpose, the goal is for each activity's effect to complement the effects of other activities and to contribute to the overwhelming effect of the whole effort in a synergisitc fashion. Each activity's purpose should be specific, attainable, relevant, and consistent with capabilities. Properly conceived, the cumulative effects will exceed the sum of the component effects and, thereby, overload the operational opponent's ability to recover. Although mastery of these fundamental time-space concepts is far from trivial, it may unnecessarily limit analysis in an evolving conflict environment.

The joint commander should consider alternative dimensions in any given contingency based on his perception of existing or potential asymmetries. Symmetrical forces, employed conventionally, gravitate towards attrition warfare and its proportional, force ratio based outcomes.[103] Asymmetric engagements have much greater potential for disproportionate outcomes and, thus, "quick, decisive

victory with minimum casualties." If the joint force commander can poise the force to exploit a decisive asymmetry, he can potentially pre-empt his enemy or key environmental threats (in the case of OOTW).

Using his intuition and imagination, the commander may discern asymmetries not specifically related to the physical dimensions of war. He should analyze his capabilities and see what basic strengths he can combine and exploit through synchronization. Potential dimensions directly effecting combat power include lethality, tempo, simultaneity, situational awareness, and survivability. These factors are not exhaustive, but they are relatively elemental. As an example, precise delivery systems and extensive acquisition means may give friendly forces a significant, exploitable advantage in lethality of operational fires. On the other hand, inability to acquire targets "over the horizon" would necessitate greater reliance on operational maneuver.

Operational dimensions that are becoming increasingly important may include perception management, legitimacy, economic pressure, environmental manipulation, and electro-magnetic vulnerability. The US has yet to demonstrate absolute resilience in any of these dimensions. In all likelihood, each of these dimensions is an operational shortcoming that bears attention in the future. As an example, a well-synchronized combination of economic enticements and perception management efforts among the factions in Bosnia might more efficiently support strategic objectives than application of combat power. Clearly anticipating the correct asymmetry to exploit

is a terrific challenge, and even more important is the requirement to correctly assess the enemy's ways and means to respond. The lesson of Iraq's ecological terrorism may be that the next under-equipped opponent will threaten even greater destruction, knowing the UN will not respond in kind and may even be risk averse.[104]

The key to successful synchronization is to not only master the coherent and efficient employment of your own capabilities, but to understand the enemy's synchronization potential as well. Massing combat power effects at a decisive point, particularly in OOTW, is no longer the sole measure of effectiveness. Efforts must, now more than ever, be synchronized with political and diplomatic actions off the battlefield and out of the theater.

This implies that operational capabilities include important potential apart from raw combat power. Synchronization of operational actions occurring over a period of days is now vulnerable to political and media feedback before the operational effect is achieved. As events unfold on the world media, adverse reaction to images and propaganda could erode public confidence (and national command authority resolve) before the operational objective could be viewed in context.[105] This requires analysis of both traditional and non-traditional dimensions of force application. We know that fires can be lethal and non-lethal, destructive or deterrent, massive or precise. The challenge is to anticipate which fires will be militarily effective, without being operationally and strategically inappropriate. Clearly, operational activities that prejudice strategic objectives are counterproductive. Whether envisioning combat power or other

means, the commander should consider interdicting the enemy's intent in tailored, theater-specific dimensions as well as the more traditional space, time, and purpose.

Planning and Decision Support

A synchronization methodology as a model supports the planning, then essentially becomes the plan. As a blueprint for the commander's vision, the synchronization model tracks events, while noting and responding to deviations from the expected chronology. Minor surprises and expected branches are accommodated within the existing plan. Major surprises result in decisions and rapid adjustments to the plan to conform to the new reality. Sequels reflect the anticipated phases of the campaign to the extent the commander retained the initiative and forced the opposition to the desired endstate. However, strategic environments and objectives change rapidly in the information age, requiring constant reevaluation of objectives, exit strategies, and plans for sequels and major branches.

At the strategic and operational level "The really crucial element of crisis management is force generation--being able to deploy forces quickly by concentrating them when and where they are required to match any . . . developing threat."[106] While high quality plans can anticipate much, improvisation will always be necessary in a crisis. Unfortunately for the operational commander, "Policies and government, especially in fast-breaking situations, be-

come reactive, following the course of events rather than directing them."[107] John C. Faith further warned

> The success of the massive deployment of units and supplies for Desert Storm was more a tribute to intelligent ad hoc decisions, hard work, and scrounged resources than to planning and deployment readiness. Next time we may not have five months to get there and get ready.[108]

As a result, General Sullivan based his recommendations for improving synchronization on three themes: expectations, priorities, and mental agility. His basic message is to prepare for the variability and complexity of the future battlefield by training to be flexible. Mastering the doctrinal basics (estimates, orders, fire control) through good training aligns individual and unit expectations with the commander's. Then commander and staff must identify key priorities (asymmetries) and focus resources towards what ***must*** be done well. Finally, "Since the physical tools of command and control have not developed as fast as the battlefield has expanded, we must compensate by becoming more capable of dealing with the unexpected."[109]

Implications for Operations Other Than War

A key operational advantage falls to the force that has the shortest lines of communications. The reality that US forces will usually have the additional burden of projecting forces to a remote theater is only partially offset by the unsurpassed capabilities of the US joint services. If the enemy, or potential threat in an OOTW situation can protect and sustain his operational effort against a joint and combined task force, it cannot succeed with the primary

task of interdiction. This becomes increasingly likely with the asymmetric engagements characteristic of OOTW.

In OOTW, the close battle may consist of security missions in support of peacekeeping or the distribution of humanitarian aid. If an opponent wants to threaten the success of the US or United Nations (UN) mission, there are many options that will frustrate the operational application of force. In particular, the enemy will have a much greater ability to pre-empt the US/UN force if he is willing to escalate the level of violence, employ ecological terrorism, or commit atrocities. The operational commander cannot tolerate these actions, but realistically neither can he often respond with raw combat power. Therefore, he must consider synchronizing in different dimensions of the battle space where he potentially can in some fashion pre-empt the threat.

> *There are many kinds of manoeuvre in war, some only of which take place upon the battlefield. There are manouevres far to the flank or rear. There are manoeuvres in time, in diplomacy, in mechanics, in psychology; all of which are removed from the battlefield, but react often decisively upon it, and the object of all is to find easier ways, other than sheer slaughter, of achieving the main purpose.* --Churchill[10]

V. CONCLUSIONS

The operational commander is challenged with synchronizing a campaign in several extremely complex ways. As he synchronizes between the levels of war, among the joint services, across phases, and throughout the dimensions of his battlespace, his ultimate aim is efficiency. General Sullivan emphasizes building shared expectations through repetition and simplicity, while focusing limited

resources on a few carefully chosen priorities.[111] Steve Metz drew similar conclusions about strategy and genius. His proposal for developing genius includes three phases applicable to the operational art: *mastery* (intellectual mastery of two diverse dimensions of strategy--mechanical and human), *transcendence* (creativity and courage to overcome organizational inertia), and *consummation* (impose new ideas and procedures, execute new paradigms).[112]

As both conventional operations and those other than war diverge more widely from our recent institutional experience, transcendence of the past and consummation of change become increasingly urgent. Despite our technological supremacy, many writers such as Alvin and Heidi Toffler warn of the dangers posed by more remote operations against less advanced weapons and tactics.[113] The asymmetries do not always benefit the superpower, and brute force is often not the best answer.

Thus, an alternative perspective for the joint commander may be based on interdiction. If he faces an opponent at the operational level, he must identify the threat center of gravity associated with the friendly strategic objective (ends). With available means he should synchronize the effort to exploit a small number of decisive asymmetries that provide the best chance of achieving surprise and pre-emption. In considering these ways to focus effects (exploiting asymmetries), creative approaches incorporating non-lethal means may achieve unprecedented results.

At the friendly tactical level, military forces must remain the most lethal and survivable forces in the world. This will insure

their credibility as the "hired guns" in OOTW, their value as a deterrent in pre-conflict scenarios, and their military effectiveness in war.

> All history teaches that no enemy is so insignificant as to be despised and neglected by any power, however formidable.[114]

In any event, the commander must thoroughly understand his enemy's options and intent to effectively interdict. His goal is to expose the opposing tactical echelon to devastating effects, whether they be political, psychological, firepower-induced or any combination. If an OOTW situation provides no enemy operational entity to target, then the commander must carefully assess all environmental threats to success. These may range from sources of operational friction (terrain, weather, cultural issues, non-governmental organizations) to multiple armed hostile factions with diverse political objectives. This is where he must most carefully synchronize his efforts with the political/economic/strategic influences acting on the population. Though outside his authority, his unique access inside the theater may make him a key source of political feedback for the strategic decision makers. Finally, in addition to mastering the complex threat environment, the joint commander must synchronize his efforts with those of any allies or coalition members. As has been observed, this may add to political synergy, but will potentially hinder military effectiveness. [115]

> "Perhaps the most serious [problem incident to the new style of warfighting] is that war as an instrument of policy might come to be seen as something other than the last resort it should remain."[116]

ENDNOTES

1. United States, Department of the Army, FM 100-5 Operations (CD-ROM) (Washington: GPO, 1993): Chapter 1.

2. "When required to employ force, JFCs seek combinations of forces and actions to achieve concentration in various dimensions, all culminating in attaining the assigned objective(s) in the shortest time possible and with minimal casualties." Note use of the word *minimal* versus *minimum*. United States, Department of Defense, JOINT PUB 3-0 DOCTRINE FOR JOINT OPERATIONS, (Washington: GPO, 1993): III-13.

3. That future wars will be joint and combined is generally undisputed and was the theme of an entire recent issue of Military Review, LXXIII, No. 11, (November 1993). In particular Major Wayne K. Maynard addressed the joint outlook based on the regional CINCs in "The New American Way of War," 5-17, and Major John D. Becker addressed the imperative of fighting with other nations in "Combined and Coalition Warfighting: The American Experience," 25-29.

4. Gordon R. Sullivan, "Delivering Decisive Victory: Improving Synchronization," Military Review, LXXII, No. 9, (September 1992): 3 (Cited hereafter as Sullivan, MR).

5. United States, Department of Defense, National Defense University Armed Forces Staff College, AFSC Pub 2 Service Warfighting Philosophy and Synchronization of Joint Forces, (Norfolk, VA: AFSC, August 1992): II-1-3.

6. A review of the Joint Electronic Library (JEL) of current joint publications for the term *synchronization* returned 122 "hits" in 17 documents. JOINT PUB 3-0 DOCTRINE FOR JOINT OPERATIONS alone returned 50 "hits," but each reference was essentially a variation of the definition.

7. Sullivan, MR, 11.

8. FM 100-5, Chapter 1 (CD).

9. In investigating tactical synchronization of combined arms, Major Clyde Long thoroughly investigated the doctrinal basis for synchronizing battlefield activities and proposed a widely implemented matrix framework to assist in the process. Clyde L. Long, "Synchronization of Combat Power at the Task Force Level: Defining a Planning Methodology," Master of Military Art and Science, Thesis, United States Army Command and General Staff College, June 1989.

10. Major Joseph Moore observes that a danger in the pursuit of synchronization is that it can require "centrally formulated, detailed plans to work." Joseph A. Moore, "Gaining Order From Chaos: Will Automation Do It?" Master of Military Art and Science, Monograph. USACGSC School of Advanced Military Studies, June 1993, 34.

11. Several authors have suggested a matrix approach analogous to Clyde Long's tactical matrix. Patrick J. Becker refines Long's approach for the operational level in "What is an Adequate Decision Support System for the Operational Level of War?" Master of Military Art and Science, Monograph. USACGSC School of Advanced Military Studies, May 1990. Michael E. Haith recommends use of an operational synchronization matrix in "CINC-ronization (Synchronization): The Critical Tenet in Future Operational Art," Master of Military Art and Science, Monograph. USACGSC School of Advanced Military Studies, June 1990, 56-57. Ronald L. Johnson recommends a decision support approach involving Program Evaluation and Review Techniques (PERT) based on the TRADOC Blueprint of the Battlefield (TRADOC Pam 11-9) in , "Decision Support Systems for Operational Level Command and Control," Master of Military Art and Science, Monograph. USACGSC School of Advanced Military Studies, June 1990, 33. James M. Dubik suggests three alternative approaches to operational synchronization matrices by variously juxtaposing service components, operational functions, and campaign phases in "A Guide to the Study of Operational Art and Campaign Design." USACGSC Advanced Operational Studies Fellow, Ft. Leavenworth: May, 1991, 29-32.

12. General Frederick Franks echoes the recurring discussion of environmental change in "Full-Dimensional Operations: A Doctrine for an Era of Change," Military Review, LXXIII, No. 12, (December 1993): 5-10.

13. Carl von Clausewitz, On War, edited and translated by Michael Howard and Peter Paret, (Princeton, NJ: Princeton University Press, 1976): 183.

14. Clausewitz, in On War, stated strategy is "the use of the engagement for the purpose of the war." He clearly envisions the strategist as the theater commander who will "draft the plan of war . . . determine the series of actions . . . shape the individual campaigns . . . decide on the individual engagements . . . and go on the campaign himself," 177. Also, "Strategy decides the time when, the place where, and the forces with which the engagement is to be fought," 195.

15. James J. Schneider proposes the contextual conditions for the operational art in "Vulcan's Anvil: The American Civil War an the Emergence of the Operational Art," Ft. Leavenworth: USACGSC, June 1991.

16. The second definition offered for the verb *synchronize* in Webster's II New Riverside Dictionary, (New York: Berkley Books, 1984): 698.

17. ". . . *a commander must regard his superior's intention as sacrosanct*, and make its attainment the underlying purpose of everything he does." Richard Simpkin, Race to the Swift (London: Brassey's, 1986): 231.

18. ". . . it is simply not possible to construct a model for the art of war that can serve as a scaffolding on which the commander can rely for support at any time. Whenever he has to fall back on innate talent, he will find himself outside the model and in conflict with it; no matter how versatile the code, the situation will always lead to the consequences we have already alluded to: *talent and genius operate outside the rules, and theory conflicts with practice.*" Clausewitz, 140.

19. Paret wrote "According to Clausewitz, experience went along way [towards helping average men cope with the complexity of human activity], but in the end appropriate guides for conduct could only grow out of a comprehensive and scientific analysis." From "The Genesis of On War," an essay in Clausewitz, 15.

20. Clausewitz, 121.

21. Clausewitz, 140.

22. Clausewitz, 140-1.

23. Clausewitz, 216.

24. General Donn Starry in his foreword to Simpkin, x.

25. Gary A.. Klein, "Strategies of Decision Making," Military Review, Vol. LXIX, No. 5 (May 1989): 58.

26. Starry foreword to Simpkin, xi.

27. Clausewitz, 120.

28. John Cushman, Thoughts for Joint Commanders, (Annapolis, MD: John Cushman, August, 1993): 8.

29. Klein, 60.

30. Simpkin, 230-1.

31. Clausewitz in further describing the principle of economy of force, stated that if any portion of the friendly force is not engaged then it is being wasted, 213.

32. "all forces for a strategic purpose should be applied *simultaneously*; their employment will be the more effective the more everything can be concentrated in a single action at a single moment." Clausewitz, 209.

33. Clausewitz, 80.

34. Simpkin offers this Russian understanding of simultaneity as the most useful general and military context, 148.

35. Clausewitz, 197.

36. A. H. Jomini, The Art of War, in The Roots of Strategy, Book 2, (Harrisburg, PA: Stackpole Books, 1987): 468.

37. Clausewitz acknowledged the potential to numerically quantify opposing forces as a part of planning engagements: "If you want to overcome your enemy you must match your effort against his power of resistance, which can be expressed as the product of two inseparable factors, viz. *the total means at his disposal* and *the strength of his will.* The extent of the means at his disposal is a matter--though not exclusively--of, figures and should be measurable." Clausewitz, 77.

38. *Momentum* is mass times tempo (distance/time) or velocity. *Leverage* is mass times depth. Thus, Momentum is the rate of change of leverage (mass x distance/time). Simpkin, 114.

39. Simpkin, 112-3.

40. Simpkin, 160-1.

41. Simpkin, 160-1.

42. Clausewitz, 220.

43. Clausewitz, 592.

44. Clausewitz, 350.

45. Clausewitz, 316.

46. Clausewitz, 601.

47. Jomini, 445.

48. Clausewitz, 217.

49. Simpkin subscribes to a largely soviet-based model of tempo, 106.

50. Simpkin, 107-8.

51. "The slower the progress and the more frequent the interruptions of military action the easier it is to retrieve a mistake, the bolder will be the general's assessments, and the more likely he will be to avoid theoretical extremes and to base his plans on probability and inference." Clausewitz goes further to say calculating probabilities requires time and the time available depends on the pace of operations, 85.

52. Clausewitz essentially agrees with Sun Tzu's injunction--No country ever benefited from a protracted war. On War, 598.

53. Clausewitz, 541. Similarly, Jomini stated as a fundamental principle: "*simple and interior lines enable a general to bring into action, by strategic movements, upon the important point, a stronger force than the enemy.*" 474.

54. This sentence combines Clausewitz' thoughts on culmination from pages 547 and 528.

55. Simpkin, 114.

56. Simpkin, 107.

57. Starry foreword to Simpkin, xi.

58. Simpkin, 97

59. Inscription on General Sherman's statue, Washington, DC, Simpkin, 269.

60. Simpkin, 140-1.

61. Starry foreword to Simpkin, x-xi.

62. Simpkin, 133.

63. From a response written by Clausewitz late in life to a friend who had proposed a purely military description of a strategic problem for comment in Peter Paret "The Genesis of *On War*," introductory essay to Clausewitz, On War, 7.

64. Wayne P. Hughes, Jr., editor, Military Modeling (Alexandria, VA: Military Operations Research Society, 1986): 3.

65. Francis P. Hoeber, Military Applications of Modeling: Selected Case Studies (New York: Gordon and Breach Science Publishers, 1981): 2.

66. Hughes, 5.

67. Derived directly from discussion of benefits and limitations of models in Hughes, 13-14.

68. Hughes, 3.

69. ". . . models are servants designed to contribute either immediately or eventually to problem solving . . ." Hughes, 12.

70. Properties for evaluating military models (per Army Models Review Committee): Consistency, Enrichment potential, Experimental validity, Military realism, Physical reasonableness, Visibility to the analyst, Credibility, Flexibility, Interface potential, Resources required, Responsiveness, Sensitivity of the model, Technical user capability, visibility to the user. Hughes, 7-8.

71. Hughes, 8.

72. Hughes borrows from Milton Weiner: "often it's not 'Let's model it so we can understand it,' but 'Let's understand it so we can model it,'" 24.

73. "The great art of modeling is to identify the primary relationships pertinent to the issue, isolate them, and study their effects." Hughes, 14.

74. Extrapolated from Hughes' discussion of the hazards of standing models. He suggests the following solutions: need single agency to maintain and refine models; users should share improvements; users should tailor the model to decision maker; users should exploit but not overestimate existing automation capabilities, 22.

75. Hughes, 13.

76. Hughes, 24.

77. Hughes, 24.

78. ". . . one does not need to know that he has *optimized* in order to institute a change; an indication of significant improvement will suffice." Hughes, 24.

79. Hughes, 3.

80. Hughes, 21.

81. Clausewitz, 141.

82. Clausewitz, 141.

83. Various synonyms for synchronize extracted from the WordPerfect Thesaurus, Version 1.1, WordPerfect Corporation, release date 11/2/92.

84. MAJ Clyde Long addressed this tendency in his widely read thesis on tactical synchronization.

85. From the definition of United States, Department of Defense, Joint Staff J7, Universal Joint Task List, (Washington: J7 Joint Exercise and Training Division, 30 September, 1993.): 2-59. "OP.4.4.4 Synchronize Operations: To arrange land, air and sea operational forces in time, space, and purpose to produce maximum relative combat power at the decisive point. This activity includes the vertical and the horizontal integration of tasks in time and space to maximize combat output. Synchronization is the activity that ensures that all elements of the operational force, including supported agencies' and nations' forces, are efficiently and safely employed to maximize the sum of their effects beyond the sum of their individual capabilities. This includes synchronizing support to a supported command. *Note: It is this task that, if effectively executed, permits the friendly operational commander to get inside the enemy commander's decision cycle and smaller forces to defeat larger forces.*"

This definition is consistent with tactical action TA.3.4.5 Synchronize Tactical Operations and Orchestrate Unified Operation and Subordinate Campaign Plans (2-36) and strategic level national task ST.5.4.3 Synchronize and Manage Global Operations and Resources (2-18) and the operational operating system 4.4.4 Synchronize Operations in TRADOC Pam 11-9 Blueprint of the Battlefield (Ft. Monroe, VA: HQ, TRADOC, 27 April 1990): 48.

86. JP 3-0, II-2.

87. JP 3-0, II-3.

88. An extended quotation: "Campaigns are joint. They serve as the focus for the conduct of war and often in operations other than war. A wartime campaign is the *synchronization* of air, land, sea, space, and special operations--as well as interagency and multinational operations--in harmony with diplomatic, economic, and informational efforts to attain national and multinational objectives." JP3-0, III-6.

89. "Massing effects, rather than concentrating forces, can enable numerically inferior forces to achieve decisive results, while limiting exposure to enemy fire," FM 100-5, Chapter 2 (CD). Haith, at the operational level, proposed this adjusted definition: "operational synchronization is the arrangement of operational forces and activities in time space, and purpose to produce maximum relative combat power effects at the decisive point . . .," 25.

90. From the definition of the operational level of war in United States, Department of Defense, JOINT PUB 1-02 DOD DICTIONARY OF MILITARY AND ASSOCIATED TERMS(JEL), Washington: GPO, 1989 (Cited hereafter as JP 1-02).

91. From JP 1-02--perception management: Actions to convey and/or deny selected information and indicators to foreign audiences to influence their emotions, motives, and objective reasoning; and to intelligence systems and leaders at all levels to influence official estimates, ultimately resulting in foreign behaviors and official actions favorable to the originator's objectives. In various ways, perception management combines truth projection, operations security, cover and deception, and psychological operations.

92. FM 100-5, Chapter 2 (CD).

93. FM 100-5, Chapter 2 (CD).

94. Jomini, 540.

95. From discussion of battle command, FM 100-5, 2-14.

96. FM 100-5, Chapter 2 (CD).

97. FM 100-5, Chapter 2 (CD).

98. FM 100-5, Chapter 2 (CD).

99. FM 100-5, Chapter 2 (CD). Battle space: "Unity of effort is essential to operations within a given battle space. Ownership of assets is less important than application of their effects toward an intended purpose. In that way, battle space can overlap, shared by two adjacent commanders who perceive ways to employ their respective assets to mutual advantage." Unity of effort: "Collateral and main force operations might go on ***simultaneously***, united by intent and purpose, if not command."

100. FM 100-5, Chapter 1 (CD).

101. Interdiction objectives from United States, Department of Defense, JOINT PUB 3-03 (Test) DOCTRINE FOR JOINT INTERDICTION OPERATIONS (Washington: GPO, 11 December, 1990): II-2.

102. "An error in the original concentration of armies can hardly be corrected during the whole course of a campaign." Helmuth von Moltke in Halo Holborn's "The Prusso-German School: Moltke and the Rise of the General Staff," Makers in Modern Strategy, edited by Peter Paret (Princeton, NJ: Princeton University Press, 1986): 289.

103. "Symmetries and Asymmetries-- **Symmetric engagements** are battles between similar forces where superior correlation of forces and technological advantage are important to ensure victory and minimize losses. Examples of symmetric conflict are land versus land (Meuse-Argonne in World War I); sea versus sea (the Battle of Jutland in World War I); air versus air (the Battle of Britain in World War II). **Asymmetric engagements** are battles between dissimilar forces. These engagements can be extremely lethal, especially if the force being attacked is not ready to defend itself against the threat." United States, Department of Defense, JOINT PUB 1 JOINT WARFARE FOR THE US ARMED FORCES (JEL) (Washington: GPO, 1991).

104. "As the war-making function was taken over by organizations that are neither European nor states, those organizations began introducing their own conceptions of the permissible that are at odds with the traditional rules. . . . certain acts previously considered as uncivilized and falling within the realm of terrorism are now beginning to spread to major interstate conflict. . . . it is already clear that the traditional rules of war, established by European or European-derived states to mitigate and impose civilized restraint on the excesses of armed conflict, are being weakened and bastardized." Martin Van Creveld, Command in War (Cambridge, MA: Harvard University Press, 1988): 36-39.

105. High and sustained public support is essential if US is called upon to act alone and with allies in "a succession of armed conflicts in various parts of the globe over the next few decades... To succeed, the nation must be able to stay the course. . . It is similarly apparent that the graphic, instant war-reporting made possible by modern technology puts civilian morale at risk of rapid erosion, however considered, just and necessary the purpose of the miliary action. It is therefore of prime importance that those responsible for our national security-civilians and military, press and public-consider this problem now and work to achieve consensus about the degree and kind of restraint to placed upon the press when we are next at war." E. L. Pattullo, "War and the American Press," Parameters, XXII, No. 4 (Winter 1992-93): 61.

106. Sir Brian Kenny, "A NATO vehicle for the road ahead,"Parameters, XXI, No. 3, (Autumn 1991): 23.

107. Antulio J. Echevarria and John M. Shaw, "The New Military Revolution: Post-Industrial Change," Parameters, XXII, No. 4 (Winter 1992-93): 77.

108. John C. Faith, "The Joint Challenge--and Opportunity," Parameters, XXI, No. 3, (Autumn 1991): 47.

109. This is a summary of the Sullivan Military Review article culminating with a quotation from page 9.

110. Winston S. Churchill (as quoted in FMFM 1), The World Crisis, vol. II (New York: Charles Scribner's Sons, 1923): 5.

111. Sullivan, MR, 7-8.

112. "The essence of strategy is efficiency. It seeks to use resources to attain goals with minimum waste and maximum chance of success. Strategists must assess, create, mobilize, integrate, and coordinate, all within a fluid range of constraints. Strategy is a demanding art which many practice and few master." Steve Metz, "The Mark of Strategic Genius," Parameters, XXI, No. 3, (Autumn 1991): 50-51.

113. The Tofflers develop a model of conflict based on first, second, and third wave armies corresponding to agrarian, industrial, and information era economies and technology bases. Alvin and Heidi Toffler, War and Anti-War--Survivial at the Dawn of the 21st Century (Boston: Little, Brown, and Co., 1993).

114. Jomini, 440.

115. "Politically, [in a coalition] the whole is greater than the sum of the parts, although militarily this may not be true. We must address the problems as simply an added dimension to the friction of war." Waldo D. Freeman, Randall J. Hess, and Manuel Faria, "The Challenges of Combined Operations," Military Review, LXXII, No. 11 (November 1992): 10.

116. Echevarria and Shaw, 78.

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